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Study on Structural Behavior of Silica Sand in Concrete

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Abstract: Concrete is one of the important construction material used in the world of all engineering works including the infrastructure development proved that it is a cheap material and its constituents are widely available in nature. Due to widespread usage and exciting infrastructure development in all over the world, there is the shortage of natural aggregates such as fine aggregate and course aggregate. These materials are available with high cost to prevent this beautiful aggregate and course aggregate can be replaced with waste materials. In this project research, fine aggregates will be replaced by silica sand accordingly in the range of 0, 10, 15 and 20% by weight of M-25 grade concrete. Concrete mixtures were prepared, tested and compared regarding compressive, split tensile and flexural strength to the conventional concrete. These tests were carried out to evaluate the strength properties for 7, 14 and 28 days.

Key words: Silica sand, concrete, structural behaviour, infrastructure, flexural strength, split tensile

INTRODUCTION

Silica sand increases the power of concrete by using in concrete. Silica sand is a heat resistance material. Thus, it prevents the formation of cracks. Micro silica on the strength of concrete with ordinary portland cement, a strength of reactive silica sand powder concrete made of local particles and application of foundry sand in civil construction are presented by Ajay *et al*. (2012), Louis (2010) and Aravindkumar (2014). With the increase in construction activities, there is the heavy demand on concrete and consequently on its ingredient like aggregate also. Use of Foundry sand in conventional concrete, normal concrete with eco sand (finely graded silica) as fine aggregate and characterisation of antibacterial phytochemicals from three coastal sand dunes in Chennai beaches are described by Bhandari and Tajne (2016), Vishnumanohar (2014) and Aravindkumar (2014). However, our objective of the project is to study and compare the strength behavior of concrete using silica sand as a partial replacement of fine aggregate (Table 1 and 2).

Table 1: Physical property of silica sand

Constituent	Values
Silica sand S.G	2.49
Bulk density	2592 (kg/m^3)
Water absorption	0.43 (%)
Moisture content	0.1-9.8
Clay lumps and friable particles	1-42
Coefficient of permeability	10-3-10-6 (cm/sec)
Plastic limit	Non plastic

Table 2: Chemical properties of silica sand

Constituent	Values (%)
SiO_2	67.22
Al_2O_3	4.27
Fe_2O_3	7.31
Ca O	0.16
Mg O	0.24
SO_3	0.87
Na_2O	0.47
K_2O	0.48
P_2O_5	0.00
Mn_2O_3	0.12
SrO	0.19
TiO_2	0.48
Loss on ignition	16.25

MATERIALS AND METHODS

The different diaries were gathered and examined on the halfway substitution of the coarse total by various materials. As per these diaries the procedure of the analysis and the strategy for the experimentation and the diverse tests directed in those diaries were considered and learned. On the premise of the investigations of the diaries gathered for the examination the test technique for the venture was pick.

As indicated by the strategy taken after for the venture, the materials were gathered for the examination, the preparatory tests were directed to the materials to know the properties, for example, particular gravity, fineness modulus and the water ingestion. In view of these properties the outline blend was done to know the amount of the materials required for the M25 grade concrete.

The examples with the three unique rates of the halfway substitution of fine total by silica sand, for example, 5, 10 and 15% alongside the control examples. The compressive, split and flexural qualities of the examples were tested.

RESULTS AND DISCUSSION

From the results, the partial replacement of fine aggregate by Silica Sand with various percentages in concrete has following conclusion (Fig. 1 and 2). About 5% achieves the maximum flexural strength for partial replacement of fine aggregate with silica sand is found to be greater than the conventional concrete. It reached maximum compressive strength when there is the partial replacement of fine aggregate with silica sand (5%). So, the maximum percentage of replacement of silica sand is 7% (Table 3 and 4).

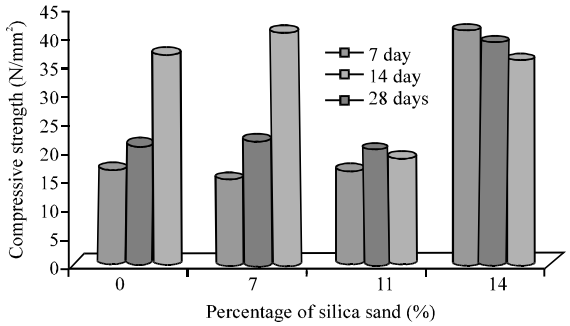

Fig. 1: Comparison of compressive strength of cubes

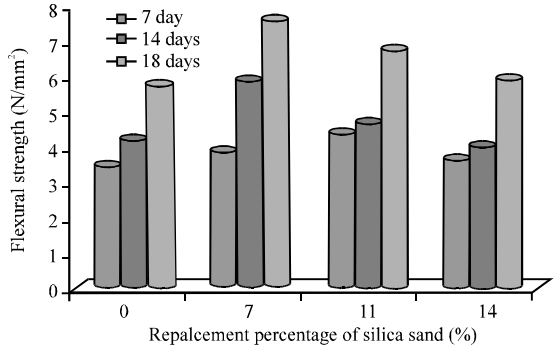

Fig. 2: Flexural strength of beams

Table 3: Test results cubes for compressive strength

	Average compressive strength (N/mm²)			
		Silica sand concrete		
Number of curing days	Conventional concrete	5 (%)	10 (%)	15(%)
7	16.88	15.23	16.71	14.66
14	21.24	22.01	20.45	18.98
28	37.72	41.36	39.24	36.19

Table 4: Test results beam for flexural strength

	Average flexural strength (N/mm²)			
		Silica sand concrete		
Number of curing days	Conventional concrete	5 (%)	10 (%)	15(%)
7	3.46	3.90	4.46	3.70
14	4.28	5.96	4.77	4.12
28	5.86	7.67	6.83	5.97

CONCLUSION

Compressive quality, split elasticity and flexural quality of solid examples expanded with increment in fine total substitution by foundry sand giving most extreme quality at 5% substitution and past that the quality parameters demonstrated a decrease in their separate esteems. The expansion in quality parameters might be because of fineness of the foundry sand. The foundry sand fineness is higher than fine total and decreases the permeable nature in concrete subsequently expanding thickness and quality. Be that as it may, diminishment in compressive quality of solid example with substitution rate past 5% is ascribed to covers exhibit in foundry sand, made out of fine powder of earth and carbon which brings about a feeble security between bond glue and total. The supplanting of common sand with utilized foundry sand up to 5% is alluring as it is practical, decreases the measure of virgin fine total, diminishes arrive fill issues and jam nature. Making solid utilizing reused materials (foundry sand) spares vitality and save essential assets and it is inferred that the more material was reused, the less assets were devoured which prompts a sheltered, maintainable condition.

REFERENCES

Ajay, V., C. Rajeev and R.K. Yadav, 2012. Effect of micro silica on the strength of concrete with ordinary Portland cement. Res. J. Eng. Sci., 1: 1-4.

Aravindkumar, A., 2014. CFD analysis of gas flow behavior in various economizer duct. Intl. J. MC Square Sci. Res., 6: 61-65.

Bhandari, P. and D.K.M. Tajne, 2016. Use of foundry sand in conventional concrete. Intl. J. Latest Trends Eng. Technol., 6: 249-254.

Louis, M.A., 2010. Strength of reactive silica sand powder concrete made of local powders. Qadisiya J. Eng. Sci., 3: 234-243.

Vishnumanohar, A., 2014. Performance of normal concrete with eco sand (finely graded Silica) as fine aggregate. Intl. J. Eng. Sci. Invention, 3: 27-35.